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EXTENSION OF COTTON PRODUCTION IN CALIFORNIA.

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INTRODUCTION.

Every season of scarcity and high prices brings renewed inquiries regarding the possibility of extending the production of cotton into new regions. The industrial uses of cotton are being increased more rapidly than facilities of production. As Europe produces scarcely any cotton, the industries of many countries are dependent upon imported raw materials. Manufacturers continually urge the need of developing more adequate and regular supplies, especially of the better classes of cotton fiber.

Experience of the frequent fluctuations of crops and prices in the American cotton belt have led to numerous attempts, subsidized by associations of manufacturers or with the direct support of governments, to increase the production of cotton in other parts of the world. Statistics show a decline in the proportion of the world's cotton crop furnished by the United States. This means that the world's demand for cotton has grown faster than the ability of this country to supply it, and that the production of cotton in other countries is increasing more rapidly than here.

Some parts of the American cotton belt have been too acutely dependent on this single crop. Many farmers who relied entirely upon

cotton were brought to disaster through the destruction of cotton by the boll weevil or by the loss of a market at the beginning of the European war. These crises were the more acute because cotton had been considered so long a safe crop and afforded new demonstrations of the danger of complete reliance of any community on a single crop. In California it is beginning to be understood that many communities are devoted too exclusively to special industries and that there is need of some such crop as cotton for opening the way toward a safer policy of more diversified farming.

In many of the tropical and subtropical regions of Asia, Africa, and America, efforts are being made to establish cotton culture as colonial enterprises on a basis of permanent competition with the United States. There can hardly be a question of the desirability of utilizing our resources of production as far as feasible. One of these undeveloped resources is the production of Egyptian cotton, which experiments have shown to be possible in Arizona and California. The need of supplementing our importations of Egyptian cotton by domestic production has recently been very acute, and the high prices that are now being paid are attracting public attention to the possibilities of cotton growing in California.

INCREASING DEMANDS FOR LONG-STAPLE COTTON.

No danger of direct competition with the older centers of cotton production in the Southeastern States is involved in the development of cotton culture in California, for the reason that it will be so obviously to the advantage of California to produce cotton that will not need to enter into competition with the South, such as the Egyptian cotton, which our manufacturers are importing on a scale of many millions of dollars every year. All previous records were exceeded in 1916, with importations amounting to about 350,000 bales, valued at more than $35,000,000.

The rapidly increasing demand for Egyptian and other superior types of cotton is due to a variety of causes, the most important being, undoubtedly, the enormous proportions attained by the automobile tire-fabric industry and the greater attention being given by manufacturers, dealers, and the public generally to the fact that strength and durability of fabrics depend very largely on the quality of the cotton fiber. Recognition of this fundamental fact in relation to automobile tires in time may be reflected in other branches of the textile industry and in turn lead eventually to a general elimination of the enormous waste of industrial effort involved in the production, manufacture, and use of weak, inferior fiber.

New communities can secure a great advantage in the production of long-staple cotton by limiting themselves to the planting of a single superior variety. In the older parts of the cotton belt, where

each farmer is likely to plant a different kind of cotton, the varieties can not be kept pure. The fiber deteriorates in quality and declines in market value. New varieties are introduced frequently, but these soon deteriorate through admixture and the neglect of selection. No general or permanent improvement can be expected as long as the condition of unorganized communities and miscellaneous planting continues.

NEW TYPES OF COTTON AVAILABLE.

As a result of experiments conducted by the Department of Agriculture for several years past in the Southwestern States, the Egyptian type of cotton has been acclimatized and superior varieties have been bred, which are now being raised on a commercial scale in the Salt River Valley of Arizona. During the same period numerous experiments have shown that the Egyptian cotton is not well adapted to replace the Upland type of cotton, either in Texas or farther east. Susceptibility to injury by drought and disease both appear much greater under conditions in the cotton belt. The need of a longer growing season is another serious handicap for the Egyptian type of cotton in the eastern United States and would exclude it from competition with Upland cotton in all of the regions that are infested by the boll weevil.[1]

Even with the same long-staple variety grown in California as in the eastern districts, there may be no direct or injurious competition. The conditions of soil, climate, and water supply in California are so different as to give the lint distinctive qualities, and there is less danger of the annual fluctuations in yield and quality of fiber that have made it unsafe for manufacturers to rely upon eastern long staples exclusively. The production of Durango cotton in the Imperial Valley, by giving it a recognized place in the market, has served to stimulate the planting of this variety in eastern districts. This relation would doubtless continue even if the production of Durango cotton in California were greatly increased, for there seems likely to be a very large demand for this type of cotton if only it can be produced with such regularity that manufacturers can rely upon adequate supplies being available. The possibility that production might be increased more rapidly than the demand must be recognized, but it does not appear to be a present danger in view of the special scarcity and high prices of the Egyptian cotton.

As eastern varieties of cotton have not proved to be well adapted to conditions in the irrigated districts of the Southwestern States,

[1] Thus, there are natural limitations to competition in either direction. The Egyptian type is sure to be preferred in the Southwestern States as long as higher prices make its cultivation more profitable. If other types are grown they are likely to be of the same general commercial character as the Egyptian, with fiber of special qualities that can not be produced to the same advantage in the Southeastern States.

there is as little occasion for farmers to undertake to bring in Upland seed from the cotton belt as to get Egyptian seed from Egypt. To make importations of Egyptian or other foreign seed is contrary to regulations under the Federal plant-quarantine law and the State quarantine law of California and is extremely dangerous on account of the possibility of introducing the boll weevil or other parasites. The ravages of the pink bollworm in Egypt, India, and other regions show that it is a very serious pest, like the boll weevil. It is of the utmost importance to keep these insects out if cotton growing is to develop in California. While regular importations of seed are prevented, the public needs to be warned of the danger from seed that may be brought in casually by travelers or immigrants from foreign countries or by settlers from Texas or other weevil-infested States.

COTTON FORMERLY GROWN IN CALIFORNIA.

In the San Joaquin Valley, cotton growing can hardly be considered as a new industry but rather as a return to a beginning that was made in the early years of the agricultural history of the State, in the middle of the last century, and maintained through the period of the Civil War and beyond. The Ninth Census, that for 1870, notes the production of 34 bales of cotton in San Diego County, but it is known that larger acreages of cotton were being planted in the San Joaquin Valley during this period.

In the report of the Tenth Census, that for 1880, published in 1884, California was included with the other cotton-growing States on a basis of production of 295 bales, grown on 375 acres in Merced County, the lack of more complete statistics being explained by a note saying that "the enumeration schedules sent to this State did not include cotton."

In the general discussion of the conditions and prospects of cotton culture in California, also published in the Tenth Census report, plantings estimated at 1,500 to 2,000 acres are said to have been made in Merced County in 1873, and in that year a firm of Merced County growers made an export shipment of 22,886 pounds of cotton to Liverpool. This seems to have marked the climax of the early efforts, but areas of 350 to 500 acres continued to be planted in the next decade, or possibly later, though no cotton was returned from California in the Eleventh Census, that for 1890.

Hilgard shows that cotton had begun to attract attention in California as far back as 1856, when a premium of $75 was offered by the State Agricultural Society for the best acre of cotton. In 1862 the State Legislature offered an aggregate of $6,500 in premiums for cotton in lots of 100 bales, the best lot to be rewarded with $3,000, but the prizes remained unclaimed until 1865, when the $3,000 was paid to a farmer in Los Angeles County who raised 108 acres, the yield

not being stated. The counties from which successful plantings were reported in the early period are Butte, Colusa, Fresno, Kern, Lake, Los Angeles, Merced, Sacramento, San Diego, Santa Barbara, Shasta, Sutter, Tulare, and Yolo. Other counties supposed to afford conditions favorable for cotton were Napa, Sonoma, and Tehama. The general conclusions reached by Hilgard from his detailed investigations of the California cotton industry in 1879 were stated as follows:

From the record above given it appears that cotton has been successfully grown at many points, practically covering the whole of the great valley, a part of the foothill lands of Shasta and a part of Napa County, and to the southward all the agricultural portion of the southern region. By inference drawn from similarity of climate and products, without direct test, we may include within the possible cotton-growing portions of the State the valleys of Napa and Sonoma, the agricultural portion of Lake County, the foothill region of Tehama, and the entire lower foothills of the Sierra. On the other hand, all the bay region, as well as the seaward valleys of the entire Coast Range, are excluded from the cotton-growing area by reason of the cool summers, trade winds, and fogs to which they are subject.

In addition it may be broadly stated that in the Sacramento Valley cotton may on deep soils be grown without irrigation, while in the San Joaquin Valley it, like all other crops, must be irrigated to insure profitable returns. The best experience seems, moreover, to indicate that, as in the case of the vine, the minimum irrigation that will enable the plant to develop is that which on the whole gives the best results, inasmuch as late irrigation especially tends to retard the opening of the bolls and in the low portions of the fields to start new growth, leaving the older bolls stationary.

The Sea Island variety is a failure thus far wherever tried. That cotton culture has not assumed larger proportions in California as yet is adequately explained by the fact that the home market is, in the absence of cotton factories, extremely limited, and the long distance from the world's markets renders competition with the Atlantic Cotton States on the one hand and with India on the other a doubtful matter, which could be turned in favor of California only by exceptional circumstances, such as peculiar excellence of the staple. At the same time, cotton production has been found profitable so far as the home demand has gone, and good prices have been obtained; and when exported the California staple has rated high in comparison with the average product of the Gulf States.

What, then, are the inducements toward an expansion of cotton culture in California and the possible establishment of cotton factories on the coast to create a home demand?

With the equalization of the prices of labor, in consequence of increased facilities of communication, there certainly is no reason why the home demand for cotton goods on the Pacific coast should not be supplied from home growth and manufacture, and there is reason why it might secure a large share of the Asiatic market, with which it is in the most direct connection.[1]

Hilgard referred to plantings of Sea Island cotton in several localities, but in no case was success reported from this type of cotton. In

[1] Hilgard, E. W. Report on the physical and agricultural features of the State of California, with a discussion of the present and future of cotton production in the State. . . p. 76–77. *In* U. S. Dept. Int., Census Off., 10th Census, v. 6, pt. 2. 1884.

a published newspaper article an ill-advised planting of over 500 acres of Sea Island cotton in Colusa County was mentioned. The cotton had only begun to bloom in October when the crop should have been ripe; yet a few Upland plants that grew in the same field had fruited abundantly. The best results were claimed for Upland short staples from Tennessee and Georgia, but an Upland long-staple variety called "Petit Gulf," from Louisiana, is said to have done well in several places.

Cotton was urged by Hilgard as a better crop than wheat for many of the lands of the central valleys, on the ground of being less likely to lead to exhaustion of the soil, as less likely to lead to harmful concentration of alkali in the surface layers of the soil on account of being a tillage crop, and as needing less water for irrigation purposes than other crops that had been proposed as substitutes for wheat. The point was made that cotton could be exported while alfalfa could not, and that the California grower would have a great advantage over his southern competitor in not having to "fight the grass."

It is evident throughout Hilgard's report that he looked upon cotton as one of the California industries that were sure to develop, and this idea finds very definite expression in the statement that closes his general discussion:

> Keeping all these points in view, the writer can not but think that the wider introduction of cotton culture into California is but a question of time, and that in many respects it will serve to improve the agricultural prosperity of the State.

EXTENT OF POSSIBLE COTTON TERRITORY IN CALIFORNIA.

Of new territory readily available for cotton in the United States, California probably has the largest areas. Recent demonstrations of cotton possibilities have been afforded by the beginnings that have been made in the Imperial Valley and the Colorado Valley in extreme southern California, but the San Joaquin and other more northern valleys contain much larger areas of irrigated or readily irrigable land that might be used for cotton. Hilgard estimated that one-third of the agricultural land of the State lay in the central valleys, with an area of more than 17,000 square miles. While only a part of this territory is suited to cotton, it seems not unreasonable to suppose that the central valleys might produce about 10 times as much cotton as the Imperial Valley.

It is to be expected that much of the cotton will be grown on the level lands in the open valley where fruits and other tender crops are excluded by low winter temperatures, but places may also be found for cotton as an additional crop in communities that are now devoted to fruit growing or other industries. Indeed, the best results are likely to be secured, at least at first, in communities that are already

established and well organized on the basis of other crops. Farmers who are familiar with the local conditions and have only to learn the requirements of the new crop are likely to make better progress than those who have everything to learn, as in communities formed of new settlers, some of them with no agricultural experience and others persisting in the use of methods to which they have been accustomed in other regions, but which are not adapted to the special conditions and requirements of the irrigated districts.

NATURAL CONDITIONS FAVORABLE.

That natural conditions of soil and climate very favorable for cotton culture are to be found in the interior valleys of California has been shown again in recent years by the behavior of series of different kinds of cotton that have been grown and studied at several points representing the general range of climatic conditions—Red Bluff, Chico, Marysville, Davis, Stockton, Dos Palos, Visalia, Exeter, Semitropic, and Bakersfield.

The general result of these experimental plantings has been to leave no doubt that cotton is able to make normal growth and mature good crops in the warmer districts of the interior valleys; that is, in the northern part of the Sacramento Valley and the southern part of the San Joaquin Valley. The most successful plantings have been those at Bakersfield and Semitropic in Kern County, and at Dos Palos in Merced County, where the plants were extremely well grown and productive, with bolls of very large size and lint of excellent quality, results that are obtained only under conditions thoroughly favorable for the development of the plants.

Much more extensive experiments would be necessary to determine how far cotton culture might be carried toward the cooler climate of the Bay districts in the central part of the State by using early short-season varieties or selecting for adaptation to the local conditions, but no special difficulties seem likely to be encountered in the warmer parts of the valleys. The cotton plant is able to thrive on a great variety of soils, a moderate but regular supply of moisture being the chief requirement. While the plants are able to survive drought, the crop is likely to be injured by any extreme condition that checks or forces the growth of the plants.

It has to be expected that any undertakings with a new crop, wherever the beginnings may be made, must pass through an experimental period, in order to test fully the possibilities of the soil and local climatic conditions and determine the methods that can be applied to the greatest advantage. The most that can be said at present is that practical experiments with cotton are likely to be justified in any of the warmer districts where soils of reasonable fertility and adequate supplies of water are available.

It is very desirable that experimental efforts in cotton growing be limited to communities in which the general agricultural conditions, as well as the present interests and activities of the community, are such as to give ground for a reasonable expectation that an annual irrigated crop like cotton, if found to thrive, would be likely to become a permanent resource. For a few scattered individual farmers to plant cotton in communities that are not likely to engage regularly in its production is not advisable. It is expensive to ship cotton seed and not worth while to install gins and oil mills unless the production of cotton reaches commercial proportions.

RETURNS THAT MAY BE EXPECTED FROM COTTON.

The first step toward the commercial planting of cotton, or considering it as a practical alternative of any other crop, is to determine whether cotton is likely to be more profitable or at least sufficiently remunerative to be added to the existing series of crops. Undoubtedly the chief obstacle to the production of cotton on a large scale in the San Joaquin Valley and other districts of California lies in the fact that attention has been directed to other industries that have been considered more profitable than cotton growing. While cotton can probably be grown on many lands that are now used only for grain or pasture, it seems reasonable to expect that at least the first beginnings with cotton in new localities will be made by farmers who are already settled on the land and engaged in the production of fruit or other intensive crops.

Even at the highest prices for cotton it should not be expected to compete with the bonanza figures that are sometimes realized from fruit crops. Though acre returns of $150 or even $200 are not altogether impossible, they can be obtained only in exceptional conjunctions of very large yields and very high prices, like those that ruled in the season of 1916, when 40 cents and upward per pound was obtained.

The most that can be considered as a reasonable expectation from cotton at moderate, normal prices is a gross return of $75 to $100 per acre. This is on the basis of Durango or some other Upland long-staple variety selling between 15 and 20 cents a pound and yielding at the rate of a bale per acre, which requires favorable conditions and good farming. The cost of production per pound increases with every reduction in yield, because the cultural operations and the irrigation water have to be applied to poor-yielding cotton as well as to good.

With a yield of a bale of 500 pounds of lint cotton the cost of picking an acre of the Durango variety is between $15 and $20, an amount about equal to the total cost of the previous care of the crop,

so that half of the return, or $35 to $50 an acre, may be reckoned as a net gain from the farm operations. With Egyptian cotton, the cost of picking must be reckoned as about double that of Durango, and the ginning of Egyptian cotton is also more expensive, roller gins being required instead of saw gins, which are used for Upland staples. To make good these differences, a premium of 4 or 5 cents a pound for the lint is necessary to render the Egyptian more profitable, but the new and rapidly increasing demand for Egyptian cotton for automobile tires and other industrial uses, and the stationary or declining production in Egypt favor a substantial premium for Egyptian. It may be that yields will average higher with Durango, in view of the fact that Egyptian cotton requires a longer season to mature a full crop, though with favorable conditions Egyptian may yield as much as Durango. Profits of $150 to $250 per acre are claimed for growers of Egyptian cotton in the Salt River Valley in 1916, but these must be considered as altogether exceptional and certainly not to be used as a basis of calculation.

It is possible that difficulties may be encountered in providing roller gins in case a greatly increased acreage of Egyptian cotton should be planted in Arizona and southern California in the season of 1917. Roller gins are not made in the United States, but have to be imported from England. The demand for them has been limited in the past to the Sea Island districts of the South Atlantic States.

LABOR REQUIREMENTS OF COTTON.

That the labor requirements of the cotton crop have not been well understood in California may be one of the chief reasons why more efforts have not been made to extend this industry before. The popular idea that large supplies of very cheap labor must be available, as in Egypt, India, China, and formerly in the American cotton belt, has been shown to be erroneous. The last and most striking demonstration of this fact is the establishment of Egyptian cotton production in the Salt River Valley of Arizona. Although labor appeared to cost about 10 times as much in Arizona as in Egypt—$2 a day, as compared with 20 cents—it has been possible by the use of farm machinery, improved cultural methods, and especially the breeding of better and more uniform varieties of cotton to make good the differences in cost of hand labor.

Egyptian cotton has been grown to advantage in Arizona for several years past, during a period of unusually low prices. The chief difficulty in the newly settled southwestern communities is not that the cost of labor is prohibitive, but that not enough labor is available when needed. This seems to have been the difficulty that was encountered in the early attempts at cotton culture in the San

Joaquin Valley, as it has been in recent years in the Imperial Valley and the Salt River Valley of Arizona. The supply of farm labor now available in the San Joaquin Valley certainly is very much greater than it was half a century ago, when irrigation agriculture was new. How much of the available labor can be applied with advantage to the care and harvesting of a cotton crop is a question that must be decided independently in each community.

Experience gained in Arizona and elsewhere in the United States in recent years does not indicate that the cotton industry requires or is limited to the use of cheap and irresponsible labor. Dependence on such labor tends rather to injure and restrict the development of cotton culture by keeping it on a low plane, limited to inferior varieties and mixed seed, so that poor and uneven lint is produced, the value of which is still further depreciated by careless harvesting and handling.

When the several unnecessary wastes and losses are taken into account and the possibilities of avoiding these are recognized, one is brought inevitably to see that the very best quality of agricultural skill and of careful, intelligent labor can be utilized in the production of cotton and that the industry is much more likely to prosper if it can leave behind the traditions of cheap labor. Hence, it is not necessary to suppose that the establishment of cotton culture in California would increase the present dependence on transient labor. It seems quite as likely to add to the permanent population by making it easier for new settlers to establish themselves.

Farm work with cotton is not of a nature to be considered as heavier or more laborious than with crops that are already grown in California. Methods of plowing, preparation, and seeding are not unlike those for corn or other tillage crops. Thinning and cultivating make less demands than for sugar beets. The gathering of the crop, though representing by far the largest item of labor cost in the production, is neither a heavy nor an unpleasant kind of work in comparison with the harvesting of many other crops. In communities of new settlers or where women and children share in the outdoor work of the farm, the planting by each family of small acreages that could be handled without extra labor would be worthy of consideration. The lint as it hangs exposed in the open bolls is perfectly clean and must be kept in that condition if it is to have the highest market value.

Careless picking diminishes the value of the fiber to the manufacturer because additional labor and machinery are required to clean the carelessly picked cotton and because some of the fiber is turned into waste as a result of the cleaning operations. An estimate of what it costs the manufacturers every year to overcome by machinery and mill labor the results of carelessness and ignorance in the produc-

tion and handling of cotton would run far into the millions, and even into the hundreds of millions. Thus, there is reason to believe that refinements in methods of production and handling, like those that have been worked out in California for fruits and other special products, could be applied with very great advantage to cotton. Although cotton is not a perishable product, its value depends very largely upon the condition in which it is placed upon the market. Taking into account the experience that agricultural communities in California have had in working out and applying special methods of production, handling, and marketing their crops, it would seem that the possibilities of producing cotton of the highest quality and placing it in the market in the best condition are more likely to be attained in that State.

Another advantage of cotton as an element of diversified farming is that it is less exigent than most other crops in demanding labor at particular times. Cotton can be planted early and thinned early or planted late and thinned late if allowance be made by leaving the plants of the later thinnings closer together. Early plantings may be made in March or as soon as the danger of cold weather is past, but the planting may continue through April and May. Even June plantings are sometimes successful.

Unlike fruits and other perishable products that have to be gathered and shipped or cured at once or within a very few days after the proper stage of maturity is reached, cotton can be picked through a long season. The bolls open at maturity, but the cotton remains in place and in dry weather suffers no injury by being left on the plants for a week, or even a month. The picking season may extend over a period of two, three, or four months.

In the interior valleys of California cotton begins to open in September. Picking probably would commence soon after the grape harvest and extend through November or even till Christmas. It is better, of course, not to wait too long after the bolls have opened, for some of the cotton is likely to fall out or become soiled or stained from rain or dust. But even these contingencies, while they reduce the value of the cotton, do not result in total loss, as they would with many other crops.

COTTON CULTURE A COMMUNITY UNDERTAKING.

With general reference to the warmer parts of the San Joaquin and Sacramento Valleys it may be said that the chief question is not whether cotton could be grown or whether its culture could be made as profitable as others that are being followed, but whether there are communities of farmers who will organize for such an undertaking. Some form of organization is a practical necessity for beginning cotton culture in a new region. Unlike many other crops that can

be grown to some advantage even on a very small scale and either used in the household or sold for local consumption, an isolated individual farmer can hope for no advantage from the planting of a small acreage in cotton.

The beginnings of cotton culture in the South Atlantic States can be traced back to the time when spinning and weaving were household industries and cotton was made into cloth and used on the same plantation where it was raised; but with the modern organization of the industry cotton has become a strictly commercial crop, grown only to be sent to market. The effect is to limit the production of cotton to districts where facilities for marketing exist or to communities that can begin cotton culture on such a scale as to enable these facilities to be provided.

In order to send cotton to market it has to be ginned, to separate the seed from the fiber, and packed into bales. For both of these operations special machinery is required; not very expensive machinery, it is true, but too expensive for the individual farmer to install for any ordinary farm acreage of cotton. Unless a community appears likely to plant 1,000 acres or more of cotton the installation of ginning machinery can hardly be considered advisable, either by the community itself or by an independent ginning company. It is not absolutely necessary that large acreages be planted the first year, since the cotton from small experimental plantings in a new community can usually be shipped to some established center where gins are in operation or can be held over in case it is decided to plant on a commercial scale during the next year.

Still larger acreages must be in prospect if a community is to be provided with its own oil mill, which is necessary for disposing of the seed to the best advantage. Oil-mill equipments are more expensive than gins, but they are not beyond the reach of large and well-organized communities, like those that own and operate fruit-packing houses and many similar undertakings in California.

COMMUNITY CONTROL OF GINS AND OIL MILLS.

Control of the gin and oil-mill equipment by the community is very desirable, not only for the financial reason of enabling the growers to secure a larger share of the profits of the industry but also for more directly agricultural reasons. It is out of the question to maintain pure stocks of seed without special precautions that are very seldom observed at privately operated commercial gins. The mixing of different varieties or stocks of seed at the gin is the most frequent cause of deterioration of the varieties, the result being to destroy the uniformity of the fiber and lessen the commercial value of the cotton produced by the community.

The careless ginning of the cotton may seriously impair the value of the fiber, injure the reputation of the product of the community, and keep the farmer from getting a full price for his crop. Long staples are more likely to suffer in this respect than short staples, for there is greater need of careful ginning. Ginning is often considered by oil-mill companies a merely incidental line of business.

Another way in which ill-advised management of oil mills has been known to interfere with the agricultural development of communities is by bringing in and recommending to the farmers seed of inferior varieties in complete disregard of the chief interest of the community on the side of producing superior fiber. In some cases attempts have even been made by the use of financial pressure to force upon farmers the planting of varieties that were distinctly inferior in quality of fiber, but were supposed to promise profits for the oil business.

AGRICULTURAL ADVANTAGES OF COMMUNITY ORGANIZATION.

In addition to the need of special care to avoid mixing seed of different kinds of cotton, there is equal need to prevent crossing in the field, which is likely to occur whenever two kinds of cotton are planted close together or even in neighboring fields. The pollen of the cotton plant is not blown about by the wind, because the surface of the grains is sticky and adherent, but bees and other insects carry the pollen, sometimes for half a mile or more. The closer the fields the greater, of course, is the liability of crossing, so that in thickly settled communities it becomes practically impossible for the individual farmer to maintain a pure stock of a superior variety of cotton.

The simplest and most effective way to avoid these dangers of admixture and deterioration of varieties is for communities to organize for the production of a single variety. The variety should be determined, whenever possible, by preliminary experimental comparisons of the behavior of the more promising sorts grown under the local conditions. The most effective test is to plant several small blocks, consisting of four or five rows of each variety, alternately in the same field, and to record the pickings of each row separately. Such tests are being conducted by the Department of Agriculture in cooperation with communities located in different parts of the cotton belt.

With only one variety grown in the community it becomes possible to preserve its purity and uniformity by selection. It is useless to expect that the fiber will continue to be uniform if the stock is allowed to deteriorate through seed admixture or cross-pollination. This not only lessens the commercial value of the fiber but diminishes the yields, the aberrant plants being less fertile than the normal in-

dividuals. Failure to maintain the purity of stocks is the basis of the popular belief that varieties of cotton soon run out. No variety should be expected to remain uniform unless selection is continued and admixture with other varieties prevented.

In addition to this primary consideration of maintaining the purity and uniformity of varieties, organized communities can deal to better advantage with most of the problems of production and marketing of the crop. Cultural methods are likely to be much better understood and more skillfully applied in a community where only one kind of cotton is grown and differences between varieties are not being confused with effects of cultural methods, soils, or seasonal conditions.

Marketing problems are also greatly simplified in communities that can offer commercial quantities of one superior variety of cotton. The classing of the cotton is a function of the community organization, whether done by local talent or by an expert employed by the community. Classing is necessary not only for selling the cotton at its true value, but for using the bales as security for loans, in case the farmer lacks ready money to meet the cost of picking or wishes to hold his cotton for better prices. Communities that have a regular system of classing and warehousing their cotton are able to arrange for loans on better terms than the individual farmer.

Community action is also very important in relation to insect pests or plant diseases. Measures of protection that can be expected to do very little good if applied only by scattering individual farmers may be rendered very effective if used by the entire community. This is notably true of the precautions that are advised against the boll weevil, but is likely to be equally so with any other parasite or disease that may appear in any district. If only a few of the parasitic insects or diseased plants are destroyed, the farmer who takes the precautions may fare no better than his more careless neighbors, but if it were possible to get action by the entire community the effect of any remedial measure would be definitely shown.

CONCLUSIONS.

Cotton was grown in California half a century ago, but the early attempts were made on a basis of direct competition with the South, which could not be maintained when normal conditions had been reestablished after the Civil War. The present possibilities of development of cotton culture in California lie in the direction of producing Egyptian or other special types of long-staple cotton. The demand for cotton of the Egyptian type is increasing rapidly and not likely to be met by increased production in Egypt, where the crop is endangered by the invasion of a new insect pest.

Experimental plantings in the region of Bakersfield indicate that the Egyptian type of cotton can be grown in the southern part of the San Joaquin Valley. No assurance can be given that Egyptian cotton will mature a crop outside of the Bakersfield-Fresno region. If plantings are to be made in the northern part of the San Joaquin Valley or in the Sacramento Valley, the Durango cotton or other long-staple Upland varieties are more likely to succeed, since they do not require as long a season as the Egyptian.

While cotton makes larger demands for hand labor than many other crops its requirements for attention at particular times usually are not so acute, which renders it well adapted for fitting in with other crops to form practical systems of diversified agriculture. Labor is needed chiefly at the picking season, which comes in the fall after the grapes and most of the other fruit crops have been harvested.

Although favorable natural conditions may be found in many places, it is not advisable to attempt to grow cotton on a commercial scale except in communities that can be organized for this purpose, so as to have an assured prospect of production on such a scale as to warrant the establishment, preferably under community auspices, of the ginning establishments and oil mills that are a part of the necessary equipment of a cotton-producing community.

Farmers in California are advised against undertaking the planting of cotton on a merely individual basis, not only because of the difficulties of handling and marketing a new crop to advantage, but also in order to avoid as far as possible the danger of attempts being made to bring in cotton seed either from the cotton belt or from Egypt. Such importations of cotton seed are now forbidden by Federal and State regulations, the object being to prevent the introduction of the boll weevil from the cotton belt and the pink bollworm from Egypt.

Another reason for advising that efforts to establish cotton culture be centralized in communities is that much more effective cooperation can be extended by the different branches of the Department of Agriculture that have been working in recent years in cooperation with new communities. The nature of the cotton industry is such that many things can be done by communities which are impracticable for the farmer who attempts to grow and market his crop individually.

Efforts to establish the cotton industry in new districts have, of necessity, to pass through an experimental period in order to determine the best variety to be grown, the special cultural methods required by the local conditions, the form of organization adapted to the community, and the most desirable system of handling and marketing, as well as to solve other problems that are encountered in developing new communities.

PUBLICATIONS ON COTTON CULTURE.

The following publications relating to the Egyptian and Durango cotton and to methods of cotton culture that are used in irrigated districts of Arizona and southern California have been issued by the Department of Agriculture:

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——— Factors affecting the production of long-staple cotton. *In* U. S. Dept. Agr., Bur. Plant Indus. Circ. 123, p. 3–9. 1913.

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——— Seed selection of Egyptian cotton. U. S. Dept. Agr. Bul. 38, 8 p. 1913.

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Scofield, C. S., Kearney, T. H., Brand, C. J., Cook, O. F., and Swingle, W. T. Community production of Egyptian cotton in the United States. U. S. Dept. Agr. Bul. 332, p. 28–30. 1916. This bulletin contains an approximately complete list of earlier publications relating to experiments with Egyptian cotton in the Southwestern States.

Taylor, Fred, and Dean, W. S. Comparative spinning tests of the different grades of Arizona-Egyptian with Sea Island and Sakellaridis Egyptian cottons. U. S. Dept. Agr. Bul. 359, 21 p. 1916.

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